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TEXTILE WORK CONNECTED WITH AMERICAN COLONIAL HISTORY.

THIS outline presupposes work as outlined in articles on "Primitive Textiles"[1] and "Basketry."[2] The social life of the period — the historical setting — is given in the history periods. The child's understanding of the daily life of a people is vivified by reproducing their typical occupations. This realization of their daily struggles is insured by his use of the actual material and the methods of their time.

One illustration of this is in the colonial cooking, where typical dishes were prepared and served. The contrast of service and customs thus brought out puts into relief present manners and customs. The character of the typical homes of the period was presented by means of descriptions and illustrations showing the development from the first rude shelter of the early colonist to that later style of architecture which was its legitimate outgrowth. Turning from food and shelter to the question of clothing, we find the colonists struggling in their dependence upon the mother-country for manufactured products and attempting to solve the problem of home production. Clothing is considered, not for the purpose of studying costume, but rather to give some idea of how it was obtained, to show the efforts of the leaders of the people to encourage the production of textile materials, the importation of implements and machines necessary to home production, and also the attention given to instruction in spinning and weaving among the younger people of the community. Such a study shows to the children in a forceful way the necessary share which industrial growth has in a life of political freedom. Industries other than textiles could illustrate these points, but the textile industry has the advantage of being associated in its beginnings with the intimate home life which developes gradually, in a way to be easily grasped by the child, to the more complex and larger industrial facts. The gradual organization at this time of itinerant workmen into small groups, and also the beginnings of factory organization brought about by the inventions then being made in textile machinery, and the application of water- and steam-power, are used to show the rapid breaking up of village industries into town factory life, and the advance made in social and industrial organization.

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[1] ELEMENTARY SCHOOL TEACHER, June, 1903.

[2] *Ibid.*, October, 1903.

The textile industry is a valuable occupation in educational work, because the processes can be duplicated in the schoolroom and planned from the materials through the child's own initiative. This makes it possible for him through his own experience to work out the evolution which actually has taken place historically.

On the theoretical side, the conditions of soil and climate were considered in connection with the physiography of the area. Maps were made showing the areas naturally favorable to the successful cultivation of fibers. Diagrams were made giving the extent of the cultivation of wool, flax, and cotton in the early colonial period in comparison with that of the present time. The tremendous increase in cotton cultivation was illustrated in previous work, when cotton was ginned for quilting and only eight ounces obtained by ten children in twenty minutes. They easily understood that one person could probably gin but one pound a day by hand, and unless some way were found to separate the seeds rapidly and without injury to the fiber, wool and flax would be used in place of cotton.

The length and structure of fibers were compared with reference to their spinning qualities and adaptability to cloth-making, and this comparison brought out the advantage of flax and wool in spinning and weaving with hand implements.

This interest in fibers was carried on to an examination of the fibers used extensively in yarn and cloth. A collection was made of the typical kinds of cloth, the analysis showing how the character of the cloth depends on the nature of the thread, and how the nature of the thread is further affected by the structure of the fiber. Upon these same conditions depends the relation of different textures to acids, alkalis, warmth, moisture, and inflammability — all of which conditions must be taken into account in an intelligent selection of cloth for personal or for household use.

In the preparation for cloth and pattern-weaving, flax and wool were the two fibers selected to work with, as a result of the previous experiments. A fleece was sorted for fine and coarse yarn; the children organizing themselves, for the sake of economy, into sorters, teasers, carders, and spinners. Flax was cultivated in the garden and also made into thread, using the simplest method of retting, heckling, and scutching. A mallet was used for breaking the flax, and a heckle was made by driving nails through a half-inch board. Wild hemp gathered from open lots near the schoolhouse was treated in the same manner. The interest in the work lay in the process, the resulting fiber being of little use.

The fact that nothing is produced either sufficient in amount or good enough in quality for use is of no importance in such experiments as the one just mentioned. Its value is rather that it explains and illustrates certain conditions of production and manufacture. No mere observation of the finished product could give the child such an understanding of the structure and properties of these materials as he gets from these apparently fruitless attempts of his own.

In order to explain the nature of the more complex textile machines of the period, the children used their knowledge of the primitive forms of carding, spinning, and weaving in formulating the development to the colonial period. From a discussion of what they had actually done in the primitive work, a definite notion of the general principle of the machine was discovered.

In order to make the class conscious of the problem — which was, in this particular case, the necessary work to be done by the carding-machine — each child, before considering the actual machine, made an original diagram of a carding-machine which could be run by power, from his knowledge based on the principle involved in the hand implements.

Several of the children worked out the device of a cylinder turning over a flat surface, getting without suggestion the notion that rollers are a necessity for machine work.

A study of spindle-sticks, whorls, and wheels dating from different historic periods makes it possible to form a theory of the invention of the spindle and its complete development through the spinning-wheel to the machine. How it grew out of the hand-work, and how improvements and changes were made to facilitate the work, was demonstrated by the children as they carried on the various forms of spinning. From the two forms of spinning known as "intermittent" (the New England wheel) and "continuous" (the German flax wheel) were demonstrated the two forms of spinning-yarns in the factory; the flexible woof-thread made on the "mule" showing the intermittent method and its close relation to the wheel, its progenitor, and the hard twisted warp made on the ring frame illustrating the "continuous" method of machine-spinning.

On the technical side, several points made clear to the children in their previous work were summed up in this year: (1) that the rotating spindle is the essential implement; (2) that improvements were possible in the mechanical means of rotating the spindle, (3) in the automatic method of attenuating the thread, and (4) in devices for working large groups of spindles. They were asked to invent a machine on which three or more spindles could be rotated automatically. This necessitated, of course, the automatic drawing and winding of the thread. Several of their original diagrams are shown in illustration.

Through the weaving done on various forms of hand-looms, which they partly invented and partly copied from looms of typical primitive peoples, they were led to understand the mechanism of the Colonial and Kentucky looms, and to appreciate the value of the attachments used to make the work automatic. Several successful inventions were actually made by the children.[3]

In the shop they made a model of a Colonial loom, and worked out a process of warping which included the construction of a warping-frame, as shown in illustration. For individual weaving a roller-beam loom was used which involved a process of warping intermediate between the Navajo warping and that used in the Colonial loom. By such methods they traced the

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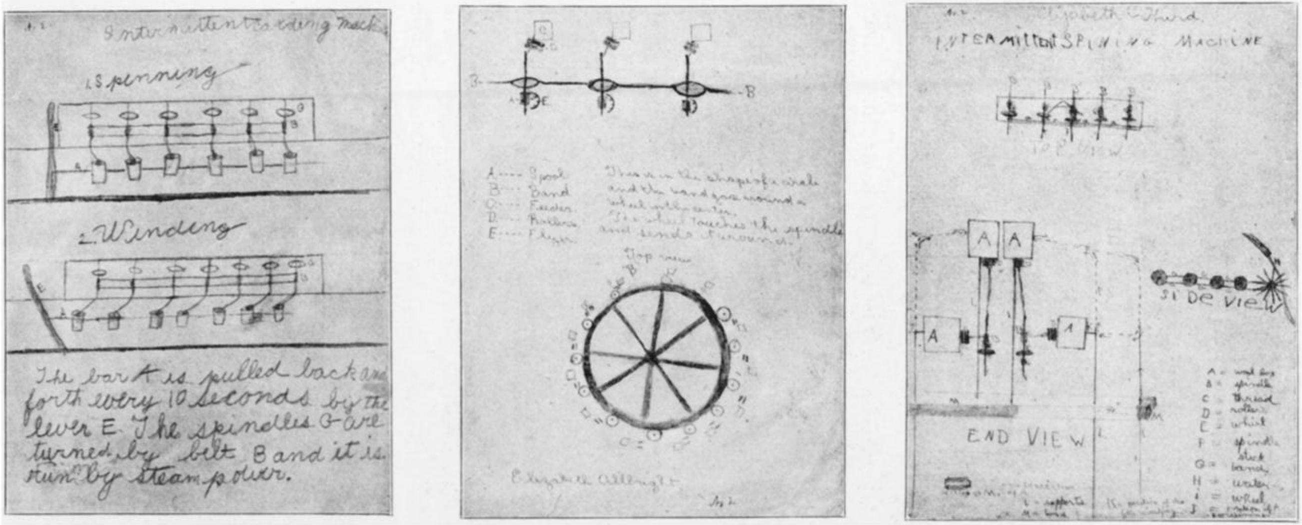
[3] See article on "Primitive Textiles."



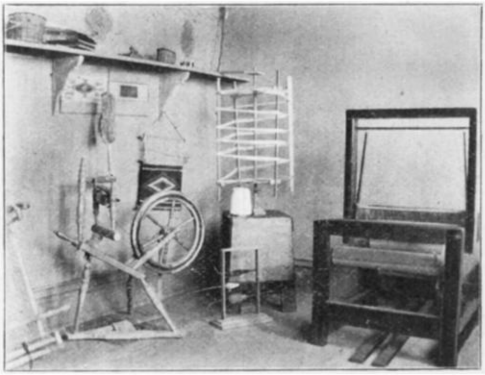
The bar A is pulled back and forth every 10 seconds by the lever E. The spindles G are turned by belt B and it is run by steam power.

This is in the shape of a circle and the band goes around a wheel with a center. The wheel touches the spindle and sends it around.

ILLUSTRATING SPINNING MACHINE.

development of warping processes as definitely as they had traced those of carding, spinning, and weaving.

These problems connected with the invention of power machines were given, not alone for the purpose of stimulating their inventive power, but also for the purpose of illustrating the problems involved in social and industrial development. The drawings and diagrams of their own inventions were compared with the principal inventions made in the eighteenth century, and also with the present factory machines. From examining the diagrams of machines, and observing these in action in the factory, it became clear that in the factory machines the principle is similar to that of the hand implements, and that the advantage of the mechanical devices lies chiefly in certain attachments which increases the speed and enables inferior fibers to be used.



VIEW OF ROOM.

A child is constantly seeking to improve his method and is keenly delighted to observe the changes which his material undergoes. Advantage can be taken of this educationally by selecting such material as will be suggestive, and will also permit of a definite approach to that phase of the work which follows naturally in the development of the subject and at the same time brings it in line with the phase of social development under consideration in the work in history.

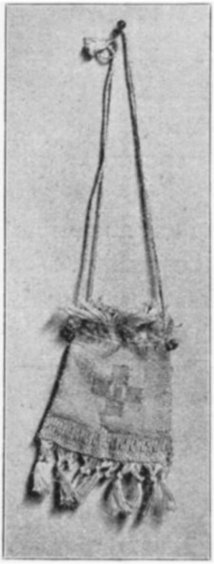
In the solution of these problems the child gets the same training that is given by abstract subjects, such as geometry, for example, with this difference, that the problems presented here are concrete, in touch with practical life, and have a historical and social background which gives them a living interest.

With the little child, the history must grow out of these active pursuits. Only through his own actions and experiences can the child realize conditions other than his own; he is not capable of abstraction and theorizing. Names and dates mean nothing unless he can make them center about the activities concerned in history, and through them understand the vital forces which have resulted in social organization. The textile industry has always had such an intimate place in the organization of society that through its dramatic history we can follow the general social progress.

In connection with the children's inventive work industrial history is closely followed. In tracing the development of the loom we read of the invention of John Kay's fly shuttle, which enabled weavers to double the work accomplished in a given time. As the spinners could not keep up with them, the result was a scarcity of yarn. This made spinning a more lucrative occupation than weaving, whereas formerly spinners had held a subordinate position; and a great impetus was given to the invention of spinning-machines.

Many of the conditions in this transition period were read and discussed: such as the position of the spinner and weaver; the beginnings of the organization of the several branches of the industry; the misunderstanding of the value of machine work, and the benefit of machine work to the community; the unfortunate position of the inventor, and the riots which followed any inventions to relieve hand-work. The children took up the problems with which men struggled when the supply and demand of yarn were so unequal as to cause weavers to travel the country for yarn, and when the equilibrium of the several branches of the industry was being adjusted in the inventions then being made. Here again maps were made showing how spinning is done at the present time in different parts of the world, whether by distaff, wheel, or machine, each child being given one country to investigate. This map gives some idea of the different periods of civilization. It also shows how in a central city, like Chicago, for example, all the forms of these survivals can be found as a result of a mingling through immigration of people in very different stages of development.

Some children have traveled considerably and from personal experience can describe primitive forms of spinning as practiced in Italy, France, Germany, Russia, etc., and also the more advanced forms in the factory centers of New England. The foreign domestics employed in the homes have been sources of information; while other children, without these resources, make use of books.

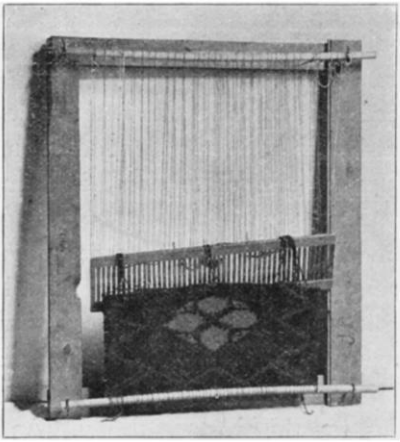


BAG.

In any work which is not purely experimental the child first plans what he will make. With a child this always has some definite use, such as clothing for a doll, furniture for a dollhouse, table-mat, belts, bags, etc. The size of the article is limited by the size of loom he can handle comfortably in the schoolroom. The proportions are planned, and a drawing is made either full size or to a scale, as required by the size of the object. A charcoal sketch is made of the article with its decorations, the two being conceived at the same time, and not separately, as is more often the case with grown people. The design usually has to be simplified when the child begins to consider his materials and the adaptation of his design to weaving. The technical design is made on cross-section paper, and the first consideration is planning the relation between the cross-section squares and the warp threads. As their proportion varies with the size and spacing of the warp threads, it becomes in each case a matter of experimentation when new material is used. A cross-section square may represent one or more warp-threads, and the relation of one to the other is a matter of calculation with each child.

It takes careful work to make the weaving exactly fit the proportions planned in the drawing. A charcoal design is next filled into the cross-section drawing in such a way as to retain as nearly as possible the character and proportion of the original sketch. This paper has wonderful and delightful surprises for the child, as a commonplace design often assumes interesting forms when transferred.

It is a matter of further calculation, when the weaving is going on, to repeat the woof-threads until they are in exact proportion to the squares. This is also an individual matter, as the materials, method of warping, and character of the weaving influence the texture.



WARPING FRAME.

In choosing the unit of design the children often conventionalize flower forms; others use geometric forms. In each case the effort of the teacher is to have the child appreciate the beauty of the unit and of good spacing. In color the children have previously used one color with the natural color of the yarn, and two or three values of one color with the natural yarn. In this year, when it is assumed that the children have handled simple color schemes, the dark-and-light scheme which is made in charcoal is planned in not more than three colors. The color schemes of the whole class are compared, and a list is made of the colors called for by the color design. The dyeing of the yarn is group work, each individual being responsible for the general principle involved in producing any color, and also for the directions for each particular color. In the dye-shop sufficient yarn of each color is dyed for the class. In the experiment with vegetable dyes the direct method of dyeing is first used — in the ordinary colors, red, blue, yellow, brown — together with the use of mordants with these same colors for indirect dyes, and also in the production of various colors and shades of color on polygenetic dyes. The effect of different fibers on the dye-stuff is one of the first observations made. After the experimentation with fibers and mordants with the pure dye-stuffs, other colors are produced by mixing the dyes, using the same principle for mixing which the child has used in handling a water-color box. Yellow and blue is one of the first combinations made in producing a green. When any of the direct dyes are crude or do not tone in with a planned color scheme, it is mixed with the color it lacks until it harmonizes with the other colors.

The question is frequently asked why we have the child return to outgrown methods of work. In introducing him to primitive conditions, we do not mean that we desire to have him repeat the progress of the race, but rather to introduce him to a scene of activities and social conditions which are simple enough for him to comprehend and in a measure control. This historical attitude toward the work does not mean any withdrawal of interest from immediate home activities. It rather strengthens the connection of home and school life, in that the child is able, through partaking in these simpler occupations, to understand many of the secrets and mysteries of modern manufactures. He is not separated from home conditions, but repeats in a simpler fashion the work of today. As his horizon widens and he himself sees larger opportunities, he is able to construct and fill in with richer content a larger whole. The method is constructive rather than analytic. In giving emphasis to this side of social history, we bring the child into closer touch with the inner life of the people with whom he is concerned in history. The textile industries were fireside occupations, and included all members of the family in helpful co-operation. In the period between the household and domestic industries, where part of the work was done by a group of workers in a central shop — as, for example, carding and fulling — the child gets ideas of simple social organization, the relation of home and community life, and the responsibility of the individual to this larger life. Following the development through the transition period, he is prepared to comprehend the purpose of factory organization. Thus, in comprehending the growth of one social occupation, and its effect upon social life and history, he is better able to take up the more intellectual problems connected with a further study of economics in secondary and college work.

It is a noticeable fact that the children who take up this later work without the primitive experience in textiles depend upon given information. They follow the lead of children whose attitude is one of inquiry and investigation, and whose creative impulse shows, not only in the discovery of processes and methods of work, but also in their artistic impulses and power in creative work. Pedagogically considered, this is the most important result of the work — this making the children scientific and self-reliant in their attitude of mind.

One important fact, not to be overlooked, is that the work is continuous throughout the child's school experience — not a piece of work of a week or a year, but an industry in which the different periods of advancement can be presented continuously, while the student is perceiving a larger social horizon and assuming larger social responsibilities.

There are two currents of experience which run into the child's work — that which he gets from his own environment, and that which he gets from a study of the past. This past which he is studying contains also these two forms of experience — the tradition and technique of each period, and the revolution which takes place through the changes and advance made in each succeeding period. At each period the question unconsciously arises: What did these people inherit, and what additions did they make to their inheritance?

This work also serves a utilitarian purpose, and leads finally to a practical end of the highest order. In opening these fields of work to the child by means of expression through materials, opportunity arises for the awakening of latent powers. His tendencies are utilized before the individual loses plasticity, and before he is hedged in by the limitations of interest and stress of everyday opinion through contact with occupations and business.

In the production of articles for actual use the joy of the child lies in the mere doing and making. His impulses, constructive and artistic, are realized in actual, concrete form. The result of his work shows any laxness or carelessness in its planning or construction. He is face to face with himself, criticism from another being superfluous. He is not only adjusting himself to the social environment, where he is constantly put to test in the organized group work, but he is also in contact with the physical environment, from which there is no escape from the judgment passed, and where excuse is futile even to himself. The moral effect of this is inevitable. Here, also, one finds an opportunity for children limited in other forms of expression, who often gain a position among their associates.

The scientific method is followed throughout. The child is made conscious of the problem and seeks his own solution in the material he uses. Aside from broadening the historical horizon, the child gains experience with the forces and materials of nature — physical facts and forces involved in the implements and machines used in balancing, weighting, and rotating the spindle. He learns the advantage of friction that makes possible the transmission of power through a belt from the large wheel to the spindle, the advantage of simultaneous winding and spinning obtained by a difference in size of the diameter of bobbin-wheel and spindle-wheel, and of the system of draw rollers for attenuating the threads. The foundation for a better understanding of chemistry is laid in the preparation, mordanting, and dyeing of fibers, yarn, cloth, etc. The study of the source of the raw material gives him geographical conditions of climate and soil. And, finally, the consummation of all of these is attained in art. The result is that the child in each period of the industry has experience along several distinct lines of work: (1) the history which is the basis of the whole; (2) the inventive and experimental work, including science, physiography, chemistry, and physics; (3) simple problems in mathematics, in planning of implements, and in the technical construction of design; (4) æsthetic expression in color and design; (5) hand-work in woodwork and textile materials.

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